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AUTHOR Simon, Hans-Reiner
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ABSTRACT

Written in German, this report summarizes a workshop on teaching and research activities in information science that was held at the City University, London, and attended by faculty and students from the university's Department of Information Science and H.-R. Simon of the GID (Gesellschaft fur Information und Dokumentation), Frankfurt am Main, West Germany. Techniques for using information collected from electronic databases to carry out research on bibliometrics are discussed, as well as ways to encourage cooperation between the Department of Information Science and the GID. Attachments to the report, which are in English, include bibliographies of 39 publications by Nicholas J. Belkin and 66 publications by R. T. Bottle; abstracts of two London University theses, "The Statistical Analysis of Bibliographic Data" (J. E. Roughly) and "Statistical Studies of Patents Literature" (Michael David Dixon); and an article entitled "Shortage of Qualified Information Workers" (R. T. Bottle, C. A. Crossley, and F. Earnshaw) reprinted from "Chemistry and Industry." (Author/EW)

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Ort:

Interner Workshop

"Knowledge based Systems in In-
formation Science"

Department of Information
Science, The City University,
London, Northampton Square

Teilnehmer:

Prof. Dr. Bottle (Direktor des
Departments)
Dr. N. Belkin (Senior Lecturer,
Dept.)
Prof. B. Brookes (Visiting Prof.,
Dept.)
Miss Helen Brooks (Central In-
formation Services, University
of London)
und Forschungsstudenten von
Bottle, Belkin und Brookes,
geladener Gast:

Dr. H.-R. Simon, GID

Verlauf:

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23.07.1984: Anreise

24.07.1984: Vorstellen des De-
partments und Beginn
des Workshops

25.07.1984: Workshop

27.07.1984: Abreise

Das Department of Information Science der City University,
London

Ausführlich vorgestellt wurden die Forschungsschwerpunkte,
insbesondere die Arbeiten von Bottle und Belkin. Die Schwer-
punkte beider Informationswissenschaftler sind der folgenden
Tabelle zu entnehmen.

Als für den Workshop relevante Themen sind zu nennen:

- Informationstransfer (Bottle)
- Wissensrepräsentation (Belkin)
und Wissenssysteme
- Theorie des Informations (Belkin)
Retrieval
- Retrieval als Dialog (Belkin)
mit dem Benutzer

Die Vorstellung einzelner Schwerpunkte als Trends in der De-

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partmentforschung einschließlich Präsentation von Examensarbeiten umfaßte

1.1 Bibliometrie

1.2 Berufsperspektiven für Informationswissenschaftler

1.3 Informationstransfer.

Als Gast stellte Simon die GID und speziell das IZ als Arbeitseinheit vor. Die Präsentation wurde eingeleitet durch Ausgaben von INFODATA-Ausdrucken der Arbeiten Bottle's und Belkin's. Dadurch war bei den Teilnehmern sofort ein spontanes Interesse für IZ-Dienstleistungen vorhanden.

In der anschließenden Diskussion ergaben sich folgende Kooperationswünsche:

- INFODATA-Anschluß für das Department of Information Science wird als sehr nützlich angesehen.

IZ - Dr. Belkin wird Kontakt mit Dr. Buxdinger aufnehmen.

Anmerkung des Berichterstatters:

Da die City University ca. 60 % aller Britischen Informationsfachleute ausbildet (MA, MSc, M Phil, PhD (Dr.)), kommt diesem Anschluß unbedingt eine Pilotfunktion zu. Die Gebührengestaltung sollte daher zunächst unter Promotionsgesichtspunkten erfolgen. Die GF wird um entsprechende Maßnahmen gebeten.

- Dr. Belkin ist einer der führenden, international anerkannten Spezialisten¹⁾ für Entwurf von Wissenssystemen im Hinblick auf eine Retrievaloptimierung. Er hat großes Interesse, ca. 1 bis 2 Wochen im IZ die Retrieval/Nutzer-schnittstellen zu studieren.

Dieser Wunsch gewinnt besondere Bedeutung durch das laufende Projekt zur Analyse von Retrievalmethoden/Techniken in Zusammenarbeit mit der London University, deren Central Information Services 1982 ca. 10 000 Recherchen durchgeführt haben. Die dort an leitender Stelle tätige Helen Brooks fertigt z. Z. unter Anleitung von N. Belkin über diesen Komplex ihre Dissertation an.

Es scheint m. E. daher einer sorgfältigen Prüfung wert, wie (auf Einladung der GID) N. Belkin ein Kurzaufenthalt als Gastforscher in der GID ermöglicht werden kann.

2. Die Arbeiten von N. Belkin zum Komplex "Wissenssysteme als

¹⁾ ISI-Preisträger 1984

1 Voraussetzung zur Optimierung des Information Retrieval".

2 N. Belkin stellte seine seit 1976 laufenden Untersuchungen
3 zum o. g. Themenkomplex vor. Die wichtigsten Komponenten im
4 dynamischen System 'Informationstransfer' sind

- 5 - der Benutzer
6 - die Informations- oder Wissensressource
7 - ein vermittelnder Mechanismus.

8 Die problematische ("wissensdefizitäre") Grundsituation des
9 Benutzers ist zunächst zu analysieren, und zwar methodisch
10 derart¹⁾, daß sich mit Hilfe der Analyseergebnisse, die dem
11 Vermittler zugänglich sind, eine optimierte Benutzung von
12 Wissens- und Informationssystemen ergibt. Dieses angestrebte
Ergebnis bezieht sich also auf die Ressourcennutzung und auf
die parallel ablaufende optimierbare Benutzerbedienung.

13 Methodische Einzelheiten wurden anhand publizierten Materials
14 vorgestellt (vgl. Nr. 8, 24, 30, 31, 34, 37, 39 (als Kor-
15 rekturfahne)).

16 Anmerkung: Alle vorstehend genannten Arbeiten (außer 39)
17 sind als Kopien beim Berichterstatter einzu-
18 sehen.

19 Aus der hier nur grob stichworthaltig umrissenen Ausgangs-
20 position war der Workshop konzipiert worden, und zwar unter
dem besonderen Aspekt der 'Wissenssysteme für Vermittler'.

21 3. Das vom Berichterstatter vorgestellte Konzept 'Knowledge
22 Systems and knowledge based Systems for Information Science'

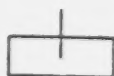
23 Die Vielfalt der Datenbanken (weltweit ca. 2 000; Stand 1983);
24 ihr unterschiedlichen Inhalte und Strukturen stellen für den
25 Informationsvermittler (IV) ein Problemfeld von wachsendem
26 Ausmaß dar. Er benötigt Übersichten zur allgemeinen Entwick-
27 lung (inhaltlich und formal) der Datenbanken; d. h., sorg-
28 fältig erhobene Indikatorenwerte, die ein Instrumentarium
29 zur besseren Handhabung der Informationsressourcen sind, z. B.
30 durch die Dichte der Datenpunkte in einer Zeitreihe aber
auch Aufschluß über allgemeine Trends im Medien- und Kommu-
nikationsgeschehen geben.

31 Unter diesen Voraussetzungen wurde das Konzept (siehe Anlage)

32 "Knowledge Systems and knowledge based
33 Systems for Information Science"

34 vom Berichterstatter vorgestellt. Die wesentlichsten inhalt-
35 lichen Komponenten des Konzepts sind die folgenden:

36 1) Dazu besonders: ASK for information retrieval. Journal of
37 Documentation, 38, 1982, Nr. 2, S. 61 - 71, Nr. 3, S. 145 -
164.



Information Systems

can be

Instruments (I)

for

Generating

of

Factual Knowledge (K_f)

(Example: Biblio-
metrics, i.e.
Development of
Medical Journals)

Results

(Graphics

Tables;

Analyses)

Results are direct
input 'material' for
IS (New K_f)

Damit ist zunächst angestrebt, ein System des Faktenwissens bereitzustellen. Dieses entstammt einer spezifischen Datenbank und wird unter einheitlichen Gesichtspunkten dargestellt, anschließend mit Fachleuten diskutiert und möglichst umfassend analysiert.

Als in Teilen durchgeführtes Beispiel wurde die Untermenge 'Medizinische Zeitschriften' der Zeitschriftendatenbank vorgestellt (S. 10 des Skriptums: Kumulierte Gesamtentwicklung 1900 bis 1980); untersucht wurden 15 000 Titel.

Eine neue Methode zur Berechnung der aktiven Titel (zum jeweiligen Jahresende) wurde der Darstellung zugrundegelegt. Die ebenfalls neu eingesetzte 'Differenzmethode' erlaubt die Ermittlung negativer 'Jahresbilanzen' im Verlauf von Zeitschriftenzeitreihen.

Diese Teilinformationen, die im Verlaufe umfangreicher Untersuchungen noch zu Gesamtübersichten erweitert werden müssen, bieten dem Informationsvermittler (IV) exakte Hinweise zum "Ressourcenprofil" einer Datenbank.

Die kurz angeführten Teilergebnisse wurden von den Teilnehmern des Workshop als sehr nützlich angesehen.

Frau H. Brooks hat sich bereiterklärt, dem Berichtersteller eine Liste mit vom IV erwünschten Daten zu übersenden.

Damit besteht die Möglichkeit, eine sehr wichtige Benutzergruppe mit gezielten Systeminformationen zu versorgen.

Im Sinne des Bundesrechnungshofes-Berichtes ist somit vonseiten der GID ein wissenschaftlich fundierter Beitrag zur vertieften Kenntnis von Informationssystemen zu liefern.

Schließlich ^{Kann} eine derartige Datensammlung auch Planern (BMFT), Verbänden u.a. Interessentengruppen zur Verfügung gestellt werden.

Eine weitere Überlegung des Berichterstatters galt und gilt der Erstellung von generellen Übersichten zur Funktionalität von Informationsdiensten. Erste Vorüberlegungen sind am Beispiel von Chemical Abstracts dargestellt (vgl. Skriptum S. 12 - 16).

Alle vom Berichtersteller vorgestellten Konzepte wurden diskutiert; eine generelle Zustimmung über die unbedingte Nützlichkeit und Durchführbarkeit derartiger faktueller Wissenssysteme liegt durch die Workshop-Teilnehmer vor.

Der Berichtersteller wurde aufgefordert, für das Journal of Information Science einen kurzen Abriss der Konzeption vorzulegen. Als Arbeitstitel wurde vereinbart: Knowledge Systems about Information Systems.

Ergänzend zu den o.g. praktischen Vorschlägen wurden auch die theoretischen Hintergründe zu den vorgestellten Konzepten diskutiert und zwar anhand der vom Berichtersteller vorgelegten generellen Aspekte der Wissensmatrix für BID-Fachpersonal (Skriptum S. 2 und 3).

Die neuen Wissenssysteme über Informationssysteme bewirken die Verringerung des 'range space' und zwar in der Weise, daß die pointer rI auf der Skala in Richtung rU rücken, bei Deckungsgleichheit ist der Idealzustand $rI = rU = 1$ erreicht.

Eine Kooperation mit N. Belkin sollte unbedingt angestrebt werden, um seine Erfahrungen und Arbeitsergebnisse voll in das vorzusehende System einer Wissensdatenbank über Informationssysteme zu nutzen.

Wie die Vorstellungen des Berichterstatters in die Arbeitsschwerpunkte von Belkin zu integrieren sind, ist auf S. 3 des Skriptums zusammengefasst.

Die prinzipielle Schwierigkeit 'Wissen' im Kommunikationsgeschehen zu bestimmen, zeigt die Graphik auf S. 4 des Skriptums. Auch hierbei ist eine Skalierung zu postulieren. Damit ist ein (zunächst) zweidimensionales Beziehungsgefüge im persönlichen Wissen und im anerkannten Wissen unterstellt.

Eine Lösungsmöglichkeit zur Verringerung des "leeren" knowledge space wird mit der ASK-Hypothese von Belkin et al. angestrebt (vgl. Skriptum S. 5).

Damit ist der Weg gewiesen zur Konzeption des Berichterstatters, die programmatisch/plakativ nach Belkin (Skriptum S. 6) nach Hall (Skriptum S. 7; unten re.) abgeleitet wird und schließlich als neuer Ansatz auf S. 8 präsentiert ist.

An Kooperationsmöglichkeiten ergeben sich:

1. Zielgruppenorientiertes Wissenssystem 'Knowledge Systems about Information Systems'

Hierzu ist die aktive Kooperation mit N. Belkin und Helen Brooks außerordentlich nützlich, da die neu generierten Daten in ein neuartiges knowledge System auf der Grundlage von Belkins ASK-Hypothese eingebracht werden können.

Dieser Ansatz führt aus der rein pragmatischen/eindimensionalen Datennutzung hinaus in ein theoretisch fundiertes übergreifendes Konzept.

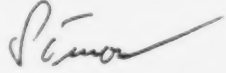
Eine Konzeption also, die für die Praxis entwickelt werden muss, jedoch den theoretischen Hintergrund nicht vernachlässigt. Daher ein Projekt, das mit hoher Priorität in der AG 'Grundlagen ...' zu bearbeiten sein wird.

2. Kooperation mit IZ:

Hier ergeben sich Möglichkeiten der angewandten Retrievalforschung mit dem Ziel einer Optimierung der Informationsressourcennutzung, der besseren Benutzerzufriedenstellung und der Fortbildung von Informationsvermittlern.

Ansprechpartner sind: Dr. N. Belkin, TCU, ; Dr. Budinger, IZ, GF.

15.8.1984


H.R. Simon

SACHGRUPPEN

PUBLIKATIONSNUMMER DER LISTEN

	NJB	RTB
Konferenzbeobachtung	1, 10, 27, 35	
Trends in der Informations Wiss.	2, 7, 13, 26, 32	
Definitionsprobleme	3,	
Konzeption der Inf. w.	4, 5, 6, 11, 14	
Wissensrepräsentation u. Wissenssysteme	8, 9, 12, 18, 19 20, 31, 37	
Retrieval als Dialog mit dem Benutzer	15, 23, 34, 38, 39	
Statistische Grundlagen der Inf. Wiss	16, 33,	
Textanalyse	17, 21, 22, 25	
Theorie des Information Retrieval	24, 25, 28, 29, 30, 37	
Benutzerschulung		12, 8, 9, 13, 17, 26, 42, 45, 49b
Benutzerforschung		10, 19, 58
Hochschulausbildung i. a. Informations-Wissenschaft		11, 18, 21, 22, 23, 24, 32, 33, 35, 38, 44, 49a, 49c, 53, 54, 55, 56, 66

NJB

RTB

Studium u. Berufsakzeptanz von Inf. Wissenschaften		12, 53,
Allg. Grundlagen der Informationswissenschaften		25, 26, 27, 43, 56
Informationstransfer		26, 27, 28, 29, 30, 31, 34, 35, 36, 39, 40, 41, 41a, 51, 52, 59, 61, 62, 63, 64
Bibliometrie einzelner Forschungsbereiche		37, 39, 46, 47, 49b, 50, 51
Bibliothekswesen		57
Wirtschaftsinformationen		60, 65,

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by R.T. Bottle

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THE STATISTICAL ANALYSIS OF BIBLIOGRAPHIC DATA

J. E. ROUGHLEY

A thesis submitted in partial fulfilment of the
requirements of the degree of Master of Science
in Information Science, at the City University

Centre for Information Science
The City University
London

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ABSTRACT

A literature review has been made of the application of statistical analysis to data concerned with the characteristics of a subject's literature. Most of the work of this nature has been done on the scattering of articles on a particular subject in the periodical literature. Bradford's original formulation of the statistical law, to which the scattering of a literature appears to conform, is given. The development of this law by other authors is traced and the statistical distributions which they formulate from Bradford's law are examined. These distributions are related to the standard statistical laws and their application in other fields. Citation analysis and user study data are also examined for statistical regularity. They appear to follow similar distributions but with different values of the parameters concerned. An indication is given of the use of the statistical distributions, which describe a literature's characteristics, in the management and planning of an information service. Some available data has been tested for conformation to the proposed distributions. Further work is needed on the relation of the parameters of the distributions to the subject and type of the data concerned.

STATISTICAL STUDIES OF

PATENTS LITERATURE

Michael David Dixon

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degree of Doctor of Philosophy

Centre for Information Science
The City University
London

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This study has been undertaken to determine what pseudo-proprietary information and patenting activity statistics could be derived from an online patents database.

To achieve this, a thorough investigation was made of patenting in the field of an important group of beta-lactam antibiotics, the Cephalosporins. Patents data was retrieved from the World Patents Index online files of Derwent Publications Limited, and the bibliographic details of each patent application retrieved analysed according to numbers of patents per patentee, priority and publication dates, types of patents, etc.

A review of technological advances in this subject was conducted, demonstrating the value of patents literature for such purposes.

The relationship between sales volumes and patenting activity for Cephalosporins patentees has been investigated and found to show a significant correlation between these parameters. As an extension, the USA patenting and sales activity for the leading USA Industrial Corporations (the 1981 Fortune 500) was studied; overall a high correlation was exhibited, but there were notable differences between different industries.

A number of bibliometric studies have been undertaken with a variety of patents data for a number of technologies. These studies include the application of Bradford-Zipf plots, other productivity studies and Vector Analysis to patents.

Whilst previous studies on journal literature have investigated the applicability of frequency distributions as measures of author productivity, this study has for the first time applied Lotka's Law, Price's Pareto-type Distribution, Simon-Yule Distribution, Shockley's Lognormal Distribution, Borel-Tanner Distribution, Williams Geometric Series, Fisher's Logarithmic Series and the Negative Binomial Distribution to patents data. Theoretical distributions were ascertained using a series of microcomputer programs written in BASIC programming language. The results indicate that of the distributions investigated, the Negative Binomial most closely fits the observed data when goodness-of-fit is measured by the Kolmogorov-Smirnov Test.

Shortage of Qualified Information Workers

By R. T. Bottle, B.Sc., Ph.D., F.R.I.C., C. A. Crossley, F.L.A. and
F. Earnshaw, B.A., A.L.A.

University of Bradford

WYATT AND CROSS have recently drawn the attention of readers of this journal to the shortage of microbiologists.¹ The results of the survey now reported show that there is similar cause for concern about the supply of professional staff for information work. Readers of the classified advertisement columns will have noticed an increasing number of opportunities in this field. Certain specific recent appointments were therefore investigated, in order to discover what sort of candidates were applying and being appointed, and what training and experience were thought desirable by employers.

Advertisements for scientific and technical librarians, information officers or scientists, and abstractors (excluding posts in academic and public libraries) which appeared during the first ten months of 1965, in *Aslib Proceedings*, *Chemistry and Industry*, *Library Association Record*, *Nature*, *Sunday Times*, and in the *Times Literary Supplement*, were collected, and in December 1965 a questionnaire was prepared and despatched. By February 1966 a total of 51 replies was received, which cover 61 posts—53 appointments and eight cases where no appointment was made. After eliminating duplicates, the total number of replies which could have been returned was 79 (65%

chemical and associated industries account for over 70% of the replies.

More than half of the posts were for information officers or information scientists, as shown in Table III. As employers did not always answer every question, there are some discrepancies between the total number of posts involved (61) and the total number shown in certain tables below.

Table III

Type of appointment	
Technical librarian	19
Information officer/scientist	32
Abstractor and/or translator	10
Mean of salary scale: Less than £1100	
£1100-£1300	6
£1301-£1500	19
£1501-£1700	10
£1701-£1900	6
£1901-£2100	4
£2101-£2300	2
Over £2500	1
No. of new posts	22
No. of replacement posts	27

Table I

Types of Employer

National and Local Government and Associated Agencies	4
Research Associations	6
Atomic Energy and other Nationalised Industries	3
Private Industry and Commerce	38

return). The distribution of respondents is shown in Tables I and II, from which it can be seen that the

Table II

Major field of interest of employer

Heavy Chemicals	3
Fine Chemicals and Pharmaceuticals	7
Plastics and Petroleum	3
Paper and Packaging	2
Food and/or Detergent Industries	6
Agriculture and Forestry	5
Metallurgical Industries	7
Power and Atomic Energy	3
Engineering	7
Business and Professional Services	3
Miscellaneous	5

Because one firm managed to attract 39 applications, through judicious advertising and contacts with University Appointments Boards, and several other very well-known firms also attracted large numbers of applicants, one might think that there was no shortage of potential information workers. A detailed examination reveals, however, that the number of candidates for 61 posts found suitable on interview was only 109. There is, unfortunately, no way of telling how many of these were applicants for several of the posts surveyed, but several posts were offered to people who declined them (usually for salary reasons).

There was obviously considerable difficulty in filling certain posts: "We have tried over a period of two years to recruit people with A.L.A. and some experience of library work in a research and development organisation. We have had no success."

One potential employer thought that not enough was being done to make university graduates aware of the opportunities in information work: "Few University Appointments Boards seem to be aware that industry does offer good jobs with excellent prospects for science graduates in the information field."

Table IV

Applicants

No. of applicants (n)	0	1-3	4-6	7-15	16-25	26-35	> 35
No. of posts with n applicants (Multiple appointments counted as one post)	2	2	11	18	6	5	2
Per cent applicants thought suitable before interview (m) (excluding posts with no applicants)	0-20	25-40	40-60	60-80	80-100		
No. of posts with m%	8	11	14	7	9		
No. of applicants found suitable on interview (s)	0	1	2	3	4-5	6-7	
No. of posts with s suitable applicants	3	16	13	9	5	3	

At least three posts were offered to candidates considered unsatisfactory by the interviewers, and in a further eight cases no appointment was made. There were various reasons: some qualified candidates were rejected because of their personal qualities; many were inadequately qualified; some lacked the necessary experience; some asked too high a salary. It was also

Many employers stressed the need for a knowledge of languages. Specific comments were as follows:

"Working knowledge of German necessary, knowledge of Russian or French desirable"—(Technical Abstractor).

"A knowledge of one or more languages is essential."—(Assistant Information Officer).

Table V

Details of Appointees

Posts filled by: Honours degree in a biological science (includes one Ph.D. and one A.L.A.)	8
Honours degree or D/T in Chemistry or GRIC (includes two M.I.Inf.Sc.)	9
Other B.Sc. Hons. (includes one A.L.A.)	2
B.Sc. (General)	3
A.M.I.Mech.E., etc.	2
Arts degree	6
Failed B.Sc. or B.A. (includes two men with Inst.Inf.Sc. qualifications)	6
A.L.A. (includes one man with both A.L.A. and A.I.Inf.Sc.)	7
M. or A.I.Inf.Sc.	6
A.I.L.	1
Formal qualifications in information work plus science degree	7
No formal training in either information work or science	11
No. of employers dissatisfied with appointee's training in information work	8
No. of employers dissatisfied with appointee's training in science	8
No. of employers dissatisfied with appointee's training in both information work and science	3
No. of employers satisfied with appointee's training in information work	12
No. of employers satisfied with appointee's training in science	18
No. of employers satisfied with appointee's training in both information work and science	11

apparent that in one or two cases candidates were appointed because their personal qualities outweighed their lack of qualifications. There was considerable evidence that a lack of sufficient scientific background was considered a definite deterrent in this field: "Applicants did not seem to realise how deep a scientific knowledge and approach was needed."

These comments reinforce the belief that for satisfactory work in a scientific or technical information service it is necessary to build on a foundation of at least a first degree in some branch of science, and preferably one which is appropriate to the information service itself.

The questionnaire also asked if, in general, for really effective information work, some postgraduate research experience was desirable. Twenty-four employers felt that it was desirable, while only two did not consider it important. Some commented specifically on this point:

"I find that research experience greatly increases the critical capacity necessary for effective information work."

"Experience very valuable, particularly for responsible post."

"Invaluable for the present post as Information Officer."

"Also knowledge of a foreign language, preferably German, highly desirable"—(Abstractor).

"Prime need is to learn languages, especially German"—(Assistant Information Officer).

"We need officers with high qualifications in the biological and/or forestry sciences, plus a wide spread of languages: this combination does not normally exist"—(Scientific Information Officer).

Although a number of employers was dissatisfied with the training of their appointees (see Table V) few were willing to release staff for more than short or part-time courses, and it therefore seems important that a professional qualification should be obtained before taking up employment in the information field. The need for such training is emphasised by the fact that in 53 appointments, only seven appointees had formal qualifications in both information work and science.

It is interesting to examine the University Grants Committee's statistics of occupations taken up by students who qualified for a degree in the academic year 1964/65. For obvious reasons it is not possible to correlate them with the figures for the posts examined above, but nevertheless they show that a very small percentage of graduates enter the information or library professions. Those entering scientific or

technical information work or librarianship will be considerably less than the numbers shown in the following table.

increasing demand for information workers which cannot be met by existing training schemes.²

The co-operation of many employers is very grate-

Table VI
Statistics of graduate employment. 1964/65.

Subject field	MEN		Total graduated	WOMEN		Total graduated
	"Editorial, information or journalism"	"Museums, library and archive work"		"Editorial, information or journalism"	"Museums, library and archive work"	
First degrees in:						
Arts and Social Studies	92 (1.1%)	40 (0.5%)	8260	97 (1.8%)	83 (1.5%)	5441
Pure Science	17 (0.3%)	4 (0.1%)	6724	28 (1.2%)	13 (0.6%)	2259
Applied Science	5 (0.1%)	1 (-)	4755	2 (1.8%)	0	110
Higher degrees in:						
Arts and Social Studies	4 (0.3%)	8 (0.7%)	1153	0	6 (2.5%)	239
Pure Science	1 (0.1%)	2 (0.1%)	2143	0	2 (1.0%)	202
Applied Science	0	0	1136	0	0	21

The survey emphasises the shortage of well-qualified personnel for information work in the chemical and allied industries, and underlines the need to provide further training courses, preferably at postgraduate level. A recent OSTI survey has shown that in the period up to 1970 there will be an

fully acknowledged, and it is hoped that they will obtain some useful information from the survey.

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